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(54) Title: PROTECTION OF METAL-BASED SUBSTRATES WITH HEMATITE-CONTAINING COATINGS

(57) **Abstract:** A method of forming a dense and crack-free hematite-containing protective layer on a metal-based substrate for use in a high temperature oxidising and/or corrosive environment comprises: (I) applying onto the substrate a mass of particles comprising hematite ( $\text{Fe}_2\text{O}_3$ ) and: (a) iron metal (Fe) with a weight ratio  $\text{Fe}/\text{Fe}_2\text{O}_3$  of at least 0.3 and preferably below 2, in particular in the range from 0.8 to 1.4; and/or (b) ferrous oxide (FeO) with a weight ratio  $\text{FeO}/\text{Fe}_2\text{O}_3$  of at least 0.35 and preferably below 2.5, in particular in the range from 0.9 to 1.7; and (II) consolidating the applied mass of particles to form the hematite-containing protective layer by heat treating the mass of particles to: 1) sinter the hematite to form a porous sintered hematite matrix; and 2) oxidise into hematite ( $\text{Fe}_2\text{O}_3$ ) the iron metal (Fe) and the ferrous oxide (FeO) to fill the sintered hematite matrix. The mechanical, electrical and electrochemical properties of the protective layer can be improved by using additives, such as oxides of titanium, zirconium and/or copper. Typically the protected substrate can be used in a cell for the electrowinning of a metal such as aluminium.

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